High Level Architecture

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Outline

- **Motivations for HLA development**

- **The High Level Architecture (HLA)**

- **HLA Transition Progress**

- **HLA in related standards efforts: JTA, NATO, SISO/IEEE, OMG**

Importance of Modeling and Simulation

Continuing squeeze on DoD resources
- shrinking, dispersed force structure
- competition for funds limits field exercises
- need to carefully examine every investment

More demanding operational requirements
- new, more complex missions
- vastly expanding mission space
- increased complexity of systems and plans
- increasing demand for joint training
- security challenges (e.g., information warfare)

Much more technical capability at less cost
- communications
- computers
- software technology
- displays/human-machine interfaces
- data storage and management

Advanced M&S can offer a cost-effective and affordable solution

US Defense M&S Vision

Defense modeling and simulation will provide readily-available, operationally-valid environments for use by DoD components

- to train jointly, develop doctrine and tactics, formulate operational plans, and assess war fighting situations
- as well as to support technology assessment, system upgrade, prototype and full scale development, and force structuring.

Furthermore, common use of these environments will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. To allow maximum utility and flexibility, these modeling and simulation environments will be constructed from affordable, reusable components interoperating through an open systems architecture.

DoD Executive Council on Modeling and Simulation (EXCIMS), March 13, 1992

US Defense-wide M&S Master Plan

Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
Develop a common technical framework for M&S	**Provide timely and authoritative representations of the natural environment**	**Provide authoritative representations of systems**	**Provide authoritative representations of human behavior**	**Establish a M&S infrastructure to meet developer and end-user needs**	**Share the benefits of M&S**

Sub-objectives	*Sub-objectives*		*Sub-objectives*	*Sub-objectives*	*Sub-objectives*
1-1 High-level architecture	**2-1** Terrain		**4-1** Individuals	**5-1** Field systems	**6-1** Quantify impact
1-2 Conceptual models of the mission space	**2-2** Oceans		**4-2** Groups and organizations	**5-2** VV&A	**6-2** Education
1-3 Data standardization	**2-3** Atmosphere			**5-3** Repositories	**6-3** Dual-use
	2-4 Space			**5-4** Communications	
				5-5 Coordination Center	

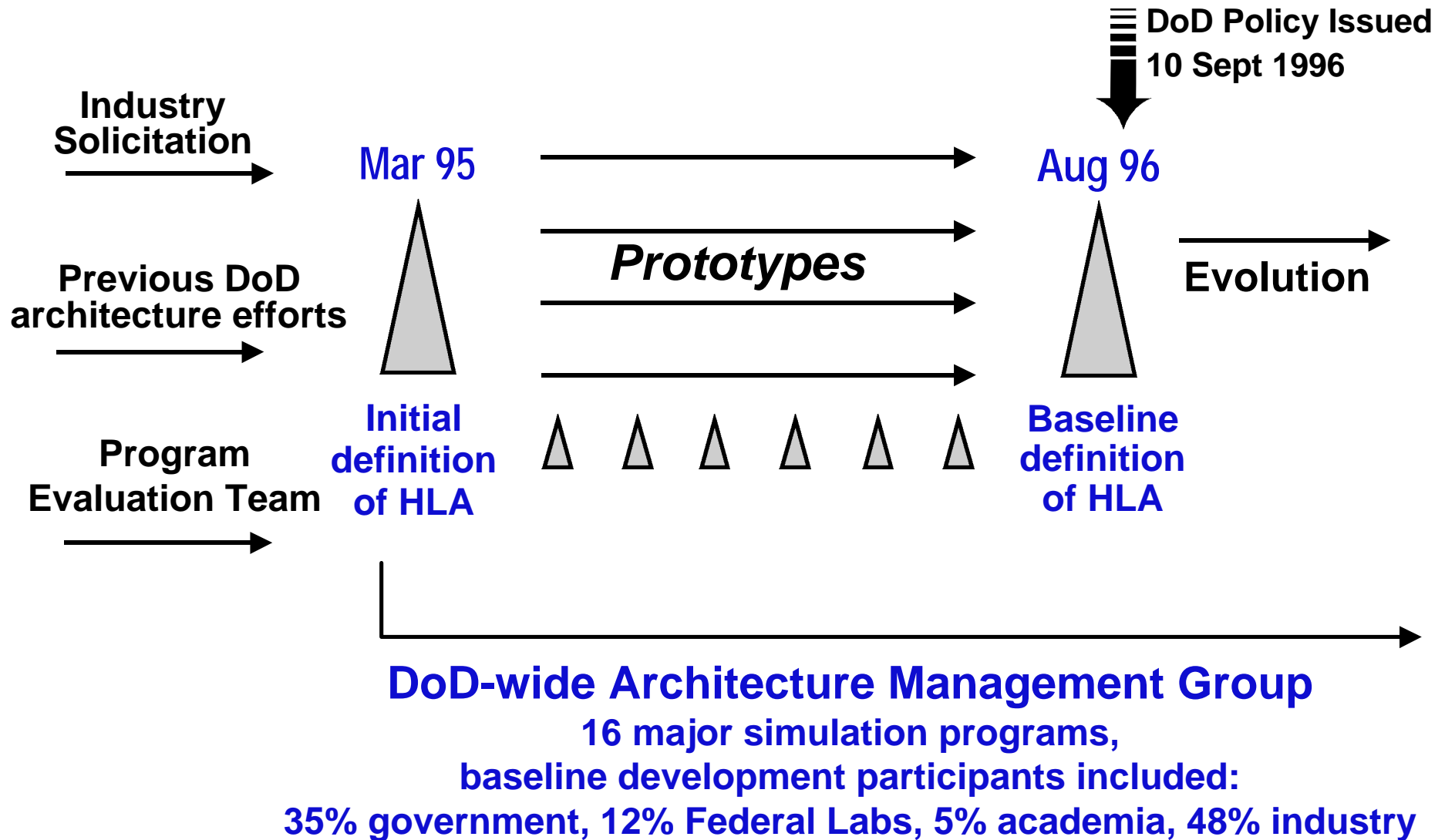## *DoD 5000.59-P, Modeling and Simulation Master Plan, October 1995*

M&S Master Plan
Objective 1-1

Objective 1-1

- **Establish a common high-level simulation architecture to facilitate the interoperability of all types of models and simulations among themselves and with C4I systems, as well as to facilitate the reuse of M&S components**

- **Simulations developed for particular DoD Components or Functional Areas must conform to the High Level Architecture**
  - **Further definition and detailed implementation of specific simulation system architectures remain the responsibility of the developing Component**

High Level Architecture (HLA) Development Process Overview

DoD Policy Issued 10 Sept 1996

Industry Solicitation

Mar 95

Prototypes

Aug 96

Evolution

Previous DoD architecture efforts

Initial definition of HLA

Program Evaluation Team

Baseline definition of HLA

DoD-wide Architecture Management Group
16 major simulation programs,
baseline development participants included:
35% government, 12% Federal Labs, 5% academia, 48% industry

Prototyping During HLA Baseline Development

- **Over 25 different simulations**

- **One Runtime Infrastructure (RTI) prototype implementation**

- **Training, analysis, and acquisition support applications**

- **Unit, platform, and weapon system component level granularity**

- **Hardware-in-the-loop, human-in-the-loop, and closed-form simulations (live, virtual, and constructive)**

- **Both real-time and fast-as-possible discrete event simulations**

- **Both classified and unclassified federations**

- **Local and wide area networks (e.g., DSI, landlines) across the USA**

- **Run on Sun, Silicon Graphics, HP, and IBM workstations**

- **Addressed issues identified by the AMG and each protofederation**

US Defense HLA Policy

DoD Policy:

"Under the authority of [DoD Directive 5000.59], and as prescribed by [the DoD Modeling and Simulation Master Plan], I designate the High Level Architecture as the standard technical architecture for all DoD simulations."

- **HLA supersedes Distributed Interactive Simulation (DIS) and ALSP**

- **"No Can" Dates**
  - **"No Can Pay"- first day of FY99**
    - **no funds for developing/modifying non-HLA-compliant simulations**
  - **"No Can Play"- first day of FY01**
    - **retirement of non-HLA-compliant simulations**

- **Waivers must be decided on a corporate basis**

Dr. Paul Kaminski, USD(A&T)
10 September 1996

HLA Evolution:
Architecture Management Group (AMG)

- **AMG continues with responsibility for technical transition and HLA evolution**

- **New AMG members have been added as new programs begin HLA implementation**
  - **HLA members are technical members of program staff; vice members of oversight office staff**

- **A disciplined issue identification/resolution process, a Technical Support Team, and experimentation are in place to ensure measured, professional evolution**

- **Six month "checkpoints"**
  - **HLA specification version 1.3 released in February 98**

Why HLA Now?

- **M&S Vision**

  - " ...common use of these environments will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. To allow maximum utility and flexibility, these modeling and simulation environments will be constructed from affordable, reusable components interoperating through an open systems architecture."

- **Embarking on development of new generation of simulations**

- **Current technology does not provide tools necessary to achieve M&S Vision (i.e., ALSP and DIS)**

Scope of HLA

- **Applicable to broad range of functional areas (e.g., training, contingency planning, analysis, and acquisition)**

- **Applicable to simulations involving pure software representations, man-in-the-loop simulators, and interfaces to live components (e.g., instrumented-weapon systems and C3 systems)**
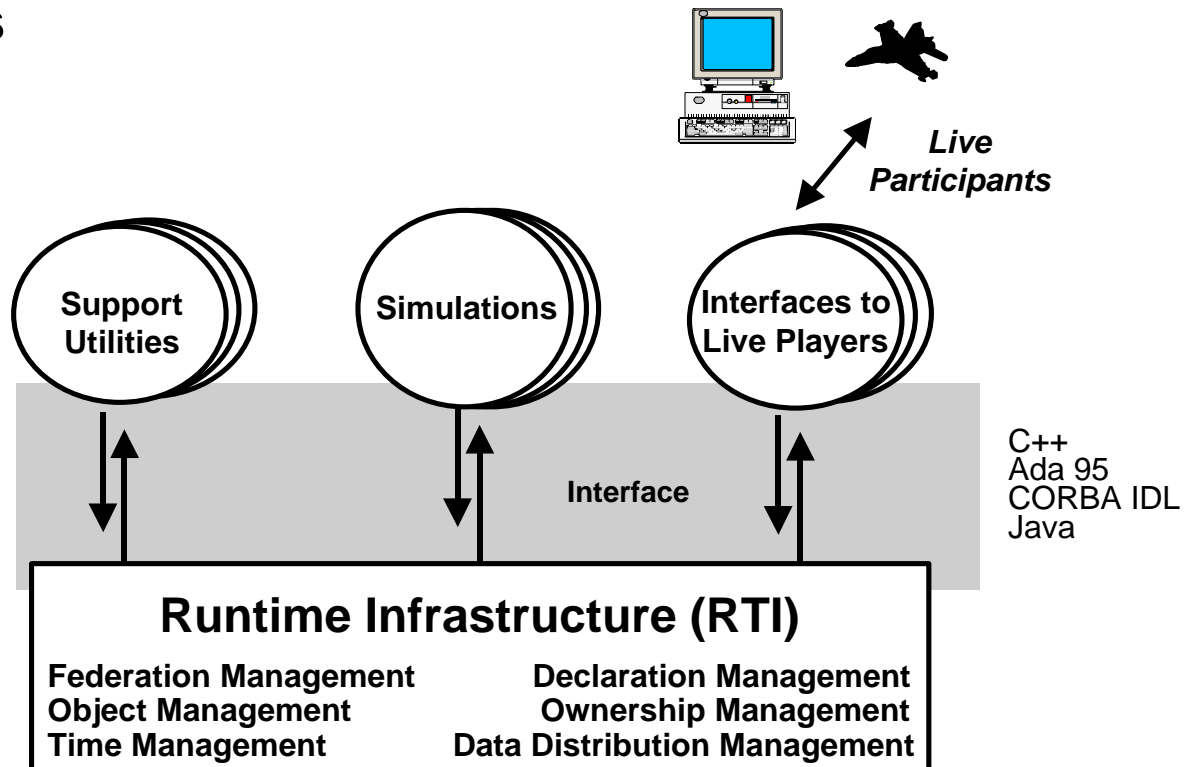
Rationale for HLA Design

- **Basic premises:**
  - No single, monolithic simulation can satisfy the needs of all users
  - All uses of simulations and useful ways of combining them cannot be anticipated in advance
  - Future technological capabilities and a variety of operating configurations must be accommodated

- *Consequence:* Need **composable** approach to constructing simulation federations

- *Resulting design principles:*
  - Federations of simulations constructed from modular components with well-defined functionality and interfaces
  - Specific simulation functionality separated from general purpose supporting runtime infrastructure

The High Level Architecture (HLA)

- **Architecture calls for a federation of simulations**

- **Architecture specifies**
  - **Ten Rules which define relationships among federation components**
  - **An Object Model Template which specifies the form in which simulation elements are described**
  - **An Interface Specification which describes the way simulations interact during operation**

Live Participants

Support Utilities

Simulations

Interfaces to Live Players

Interface

C++
Ada 95
CORBA IDL
Java

Runtime Infrastructure (RTI)

Federation Management   **Declaration Management**
Object Management   **Ownership Management**
Time Management   **Data Distribution Management**

The HLA is not the RTI; the HLA says there will be an RTI that meets HLA requirements but it doesn't specify a particular software implementation

Some Terminology

- **Federation**: a set of simulations, a common federation object model, and supporting RTI, that are used together to form a larger model or simulation

- **Federate**: a member of a federation; one simulation
    - Could represent one platform, like a cockpit simulator
    - Could represent an aggregate, like an entire national simulation of air traffic flow

- **Federation Execution**: a session of a federation executing together

Some More Terminology

- **Object**: An entity in the domain being simulated by a federation that
  - Is of interest to more than one federate
  - Is handled by the Runtime Infrastructure

- **Interaction**: a non-persistent, time-tagged event generated by one federate and received by others (through RTI)

- **Attribute**: A named datum (defined in Federation Object Model) associated with each instance of a class of objects

- **Parameter**: A named datum (defined in Federation Object Model) associated with each instance of a class of interactions

HLA Object Models and OMT

- **Federation Object Model (FOM)**

  - **A description of all shared information (objects, attributes, and interactions) essential to a particular federation**

- **Simulation Object Model (SOM)**

  - **Describes objects, attributes and interactions in a particular simulation which *can* be used externally in a federation**

- **Object Model Template (OMT)**

  - **Provides a common framework for HLA object model documentation**
  - **Fosters interoperability and reuse of simulations via the specification of a common representational framework**

OMT Components

- **Object Model Identification Table**

- **Object Class Structure Table**

- **Interaction Class Structure Table**

- **Attribute Table**

    - **Enumerated Datatype Table**

    - **Complex Datatype Table**

- **Parameter Table**

- **Routing Space Table**

- **FOM/SOM Lexicon**

Tables in the Object Model Template

Routing Space Table

Parameter Table

Attribute Table

Interaction Class Structure Table

Object Class Structure Table

Object Model Identification Table	
Category	**Information**
Name	
Version	
Date	
Purpose	
Application Domain	
Sponsor	
POC	
POC Organization	
POC Telephone	
POC Email	
Name	Strike Simulation SOM
Version	1.0 Alpha
Date	1 Jan 1998
Purpose	To provide an example of an object model for a federate that simulates strike operations.

Object Model Identification Table

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Object Class Structure Table

Object Class Structure Table			
<class> (<ps>)	[<class> (<ps>)]	[<class> (<ps>)]	[<class> (<ps>)] [,<class> (<ps>)]* | [<ref>]
		[<class> (<ps>)]	[<class> (<ps>)] [,<class> (<ps>)]* | [<ref>]
		...	...
		[<class> (<ps>)]	[<class> (<ps>)] [,<class> (<ps>)]* | [<ref>]
	[<class> (<ps>)]	[<class> (<ps>)]	[<class> (<ps>)] [,<class> (<ps>)]* | [<ref>]
		...	...
		[<class> (<ps>)]	[<class> (<ps>)] [,<class> (<ps>)]* | [<ref>]
	...	...	...
Air Vehicle (S)	Fixed Wing (S)	Fighter-Attack (S)	F-14 (PS)
			F-16 (PS)
			F-18 (PS)
		Bomber (S)	B-1 (PS)
			B-2 (PS)
	Rotary Wing (PS)		

Interaction Class Structure Table

Interaction Class Structure Table			
<class> (<isr>)	[<class> (<isr>)]	[<class> (<isr>)]	[<class> (<isr>)] [,<class> (<isr>)]* | [<ref>]
		[<class> (<isr>)]	[<class> (<isr>)] [,<class> (<isr>)]* | [<ref>]
		...	...
		[<class> (<isr>)]	[<class> (<isr>)] [,<class> (<isr>)]* | [<ref>]
	[<class> (<isr>)]	[<class> (<isr>)]	[<class> (<isr>)] [,<class> (<isr>)]* | [<ref>]
		...	...
		[<class> (<isr>)]	[<class> (<isr>)] [,<class> (<isr>)]* | [<ref>]
	...	...	...
Weapon Detonate (S)	Weapon Detonate at Sea Target (R)	Weapon Detonate at Surface Ship (R)	Weapon Detonate at Cruiser (IR)
			Weapon Detonate at Carrier (IR)
			Weapon Detonate at Destroyer (IR)
		Weapon Detonate at Submarine (IR)	
	Weapon Detonate at Land Target (IR)		
	Weapon Detonate at Air Target (R)	Weapon Detonate at Fighter (IR)	
		Weapon Detonate at Bomber (IR)	

Attribute Table

Attribute Table

Object	Attribute	Data-type	Cardi-nality	Units	Resolution	Accuracy	Accuracy Condition	Update Type	Update Condition	T/A	U/R	Routing Space
<class>	<attribute>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<type>	<rate> | <condition>	<ta>	<ur>	<r_space>
	<attribute>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<type>	<rate> | <condition>	<ta>	<ur>	<r_space>
	...	...	...	...	...	...	...	...	...	...	...	...
<class>	<attribute>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<type>	<rate> | <condition>	<ta>	<ur>	<r_space>
	<attribute>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<type>	<rate> | <condition>	<ta>	<ur>	<r_space>
	...	...	...	...	...	...	...	...	...	...	...	...
Tank	Area	Float	1	m2	0.1	perfect	always	cond	scen events	TA	UR	N/A
	Velocity	Double	1	m/sec	.01	.01	none	periodic	10 Hz	TA	UR	N/A
	State	Tank_Type	1	n/a	n/a	n/a	n/a	cond	scen events	TA	UR	Location
	Position	Rec_Type	1	n/a	n/a	n/a	n/a	periodic	10 Hz	TA	UR	Location

Parameter Table

Parameter Table								
Interaction	**Parameter**	**Data-type**	**Cardi-nality**	**Units**	**Resolution**	**Accuracy**	**Accuracy Condition**	**Routing Space**
<interaction>	<parameter>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<r_space>
	<parameter>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	
	...	...	...	...	...	...	...	
<interaction>	<parameter>	<datatype>	[<size>]	<units>	<resolution>	<accuracy>	<condition>	<r_space>
	...	...	...	...	...	...	...	
Weapon Detonate	Weapon Location	Rec_Type	1	N/A	N/A	N/A	N/A	N/A
	Warhead Size	Unsigned Short	1	lbs	1.0	perfect	always	
	Warhead Type	WH_Type	1	N/A	N/A	N/A	N/A	

Routing Space Table

Routing Space Table					
Routing Space	**Dimension**	**Dimension Type**	**Dimension Range/Set**	**Range/Set Units**	**Normalization Function**
<r_space>	<dimension>	<type>	<range/set>	<units>	<n_function>
	<dimension>	<type>	<range/set>	<units>	<n_function>
	<dimension>	<type>	<range/set>	<units>	<n_function>
...	...	...	...	...	...
<r_space>	<dimension>	<type>	<range/set>	<units>	<n_function>
	<dimension>	<type>	<range/set>	<units>	<n_function>
Location	X_dim	float	(0-100]	km	linear(X)
	Y_dim	float	(0-100]	km	linear(Y)

Interface Specification

- **Provides a specification of the functional interfaces between federates and the RTI**
  - **Interfaces are divided into six service groups**

- **Each service specification includes:**
  - **Name and Descriptive Text**
  - **Supplied Arguments**
  - **Returned Arguments**
  - **Pre-conditions**
  - **Post-conditions**
  - **Exceptions**
  - **Related Services**

- **Application Programmer Interfaces (APIs) in CORBA IDL, C++, Ada '95 and Java**

HLA RTI Service Categories

Category	Functionality
Federation Management	Create and delete federation executions Join and resign federation executions Control checkpoint, synchronization, restart
Declaration Management	Establish intent to publish and subscribe to object attributes and interactions
Object Management	Create and delete object instances Control attribute and interaction publication Create and delete object reflections
Ownership Management	Transfer ownership of object attributes
Time Management	Coordinate the advance of logical time and its relationship to real time
Data Distribution Mgmt	Supports efficient routing of data

What does the Interface Specification include?

- **Six HLA Runtime Infrastructure Service Groups**
  - **Federation Management   (20 services)**
  - **Declaration Management   (12 services)**
  - **Object Management   (17 services)**
  - **Ownership Management   (16 services)**
  - **Time Management   (23 services)**
  - **Data Distribution Management   (13 services)**

- **The Interface Specification also includes:**
  - **Support Services   (29 services)**
  - **Management Object Model**
  - **Federation Execution Data (FED)**
  - **Application Programmers Interfaces (APIs)**
  - **Harel state charts**

HLA RTI Services over the Life of a Federation

Startup   *Operations*   *Shutdown*

Ownership Management

Time Management

Data Distribution Management

Object Management

Declaration Management

Federation Management

Time →
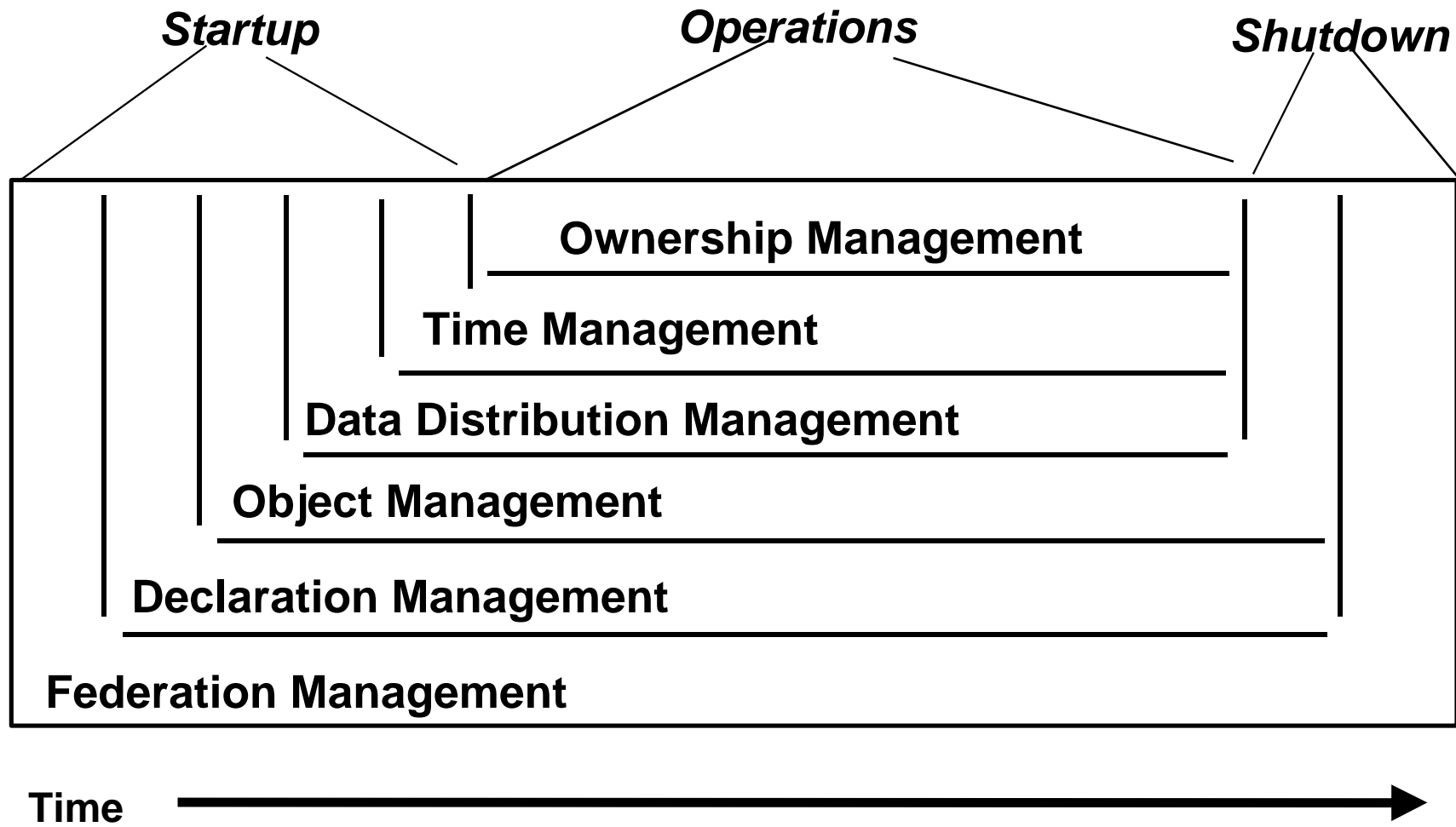
Federation Rules

1 **Federations shall have an HLA Federation Object Model (FOM), documented in accordance with the HLA Object Model Template (OMT).**

2 **In a federation, all representation of objects in the FOM shall be in the federates, not in the runtime infrastructure (RTI).**

3 **During a federation execution, all exchange of FOM data among federates shall occur via the RTI.**

4 **During a federation execution, federates shall interact with the runtime infrastructure (RTI) in accordance with the HLA interface specification.**

5 **During a federation execution, an attribute of an instance of an object shall be owned by only one federate at any given time.**

Federate Rules

6 **Federates shall have an HLA Simulation Object Model (SOM), documented in accordance with the HLA Object Model Template (OMT).**

7 **Federates shall be able to update and/or reflect any attributes of objects in their SOM and send and/or receive SOM object interactions externally, as specified in their SOM.**

8 **Federates shall be able to transfer and/or accept ownership of attributes dynamically during a federation execution, as specified in their SOM.**

9 **Federates shall be able to vary the conditions (e.g., thresholds) under which they provide updates of attributes of objects, as specified in their SOM.**

10 **Federates shall be able to manage local time in a way which will allow them to coordinate data exchange with other members of a federation.**

HLA Support Processes

- **Formalized views of use processes of HLA to support HLA application**

- **Federation Execution & Development Process (FEDEP)**
  - **Describes major stages in the creation and use of an HLA federation**
  - **Developed and evolved based on user experience**
  - **Provides framework for tools development, security and VV&A processes**

HLA FEDEP Model
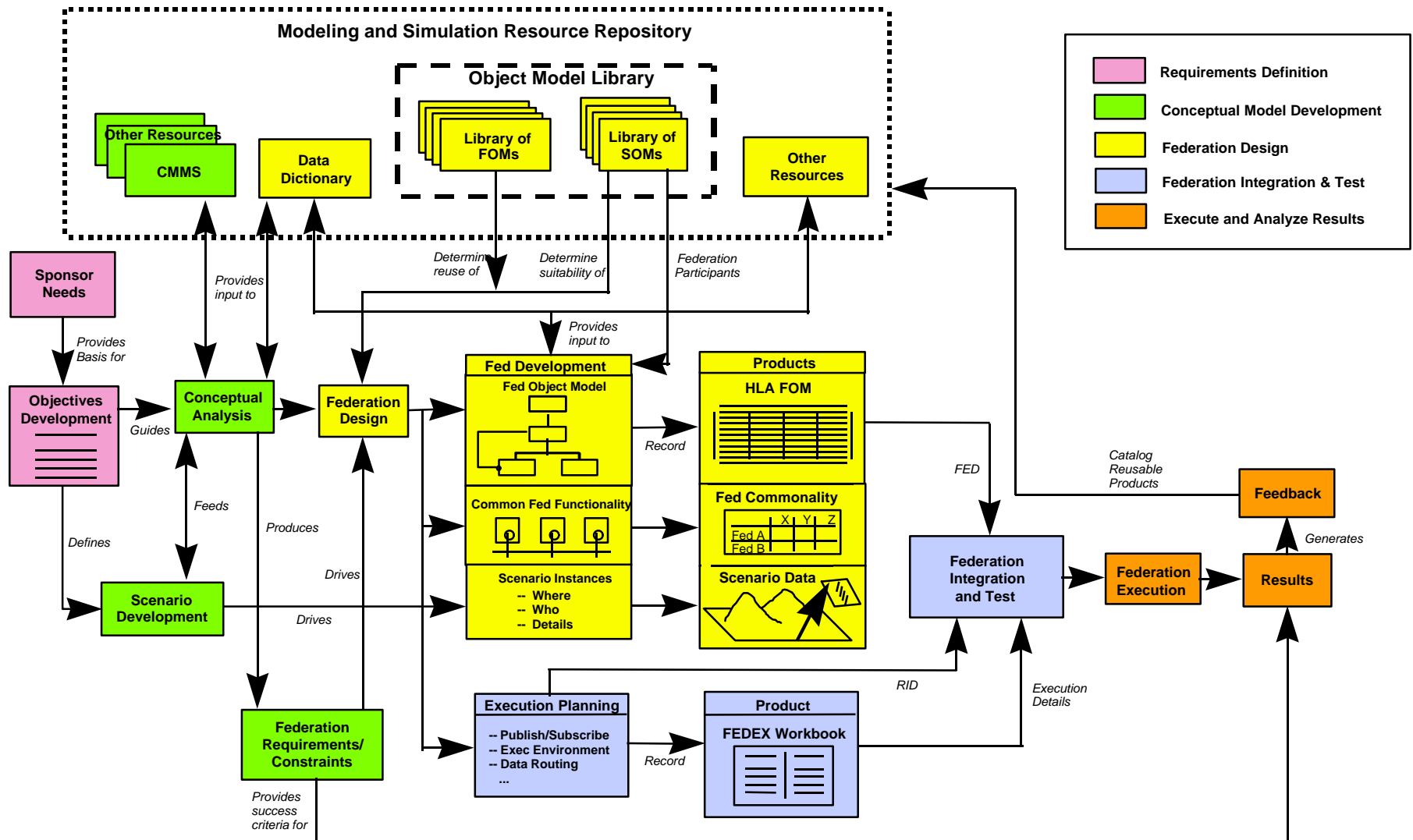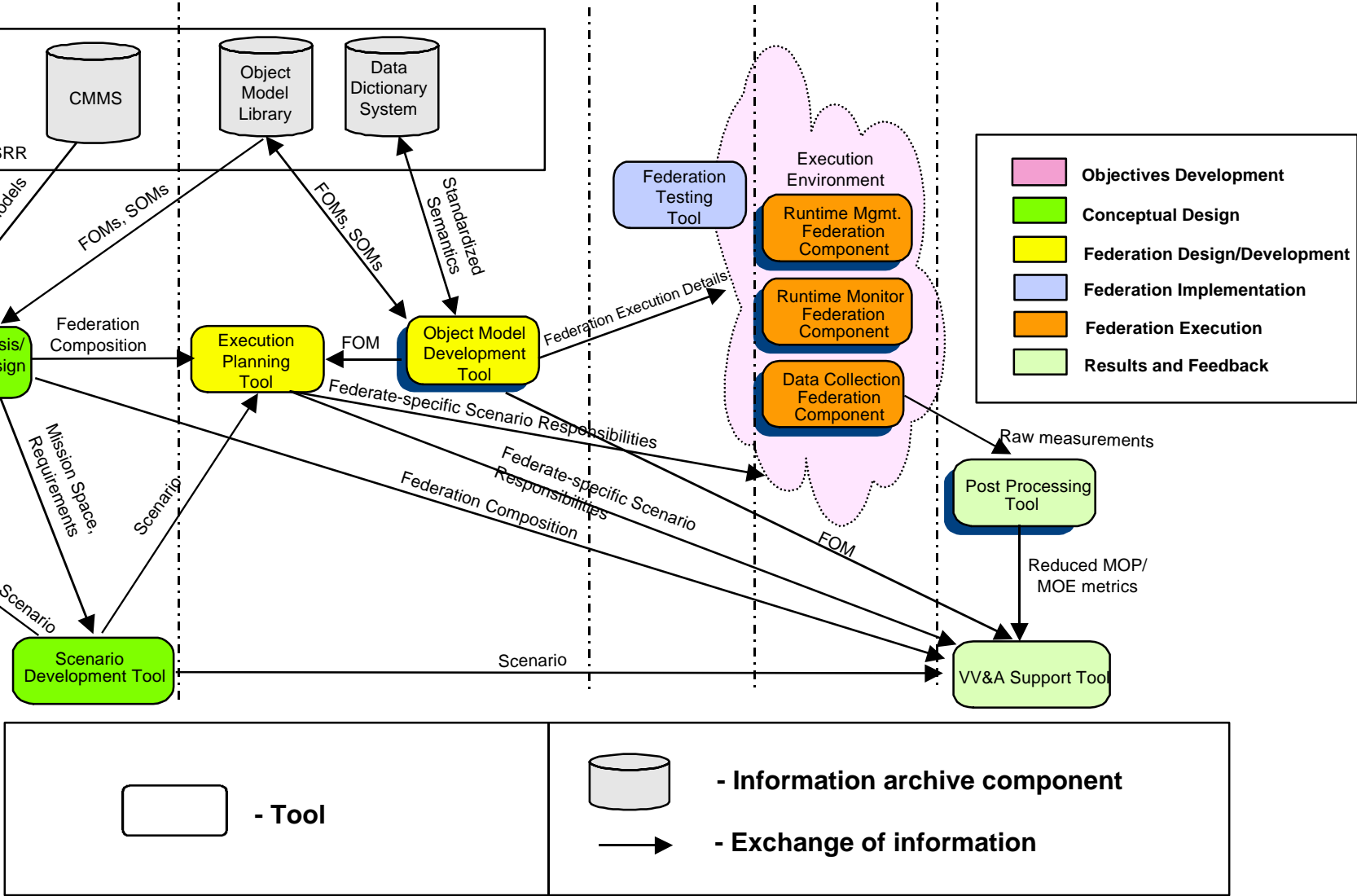
HLA Supporting Tools Philosophy

- **HLA is an architecture, not software -- however, to facilitate cost-effective implementation of HLA, DMSO is developing an initial suite of HLA supporting software (including Runtime Infrastructure software and a variety of integrated tools)**

- **DMSO facilitates open distribution of supporting tools in the public domain**

  - **Open access to specifications (e.g., Object Model Template data interchange format) to foster development of commercial software to support HLA**

  - **Several DoD agencies have ongoing SBIR initiatives to develop HLA support tools**

- **Information source: HLA On-line (subscribe at http://www.dmso.mil)**

  - **Open mailing list for updates on HLA and information on HLA supporting software (over 1,000 subscribed)**
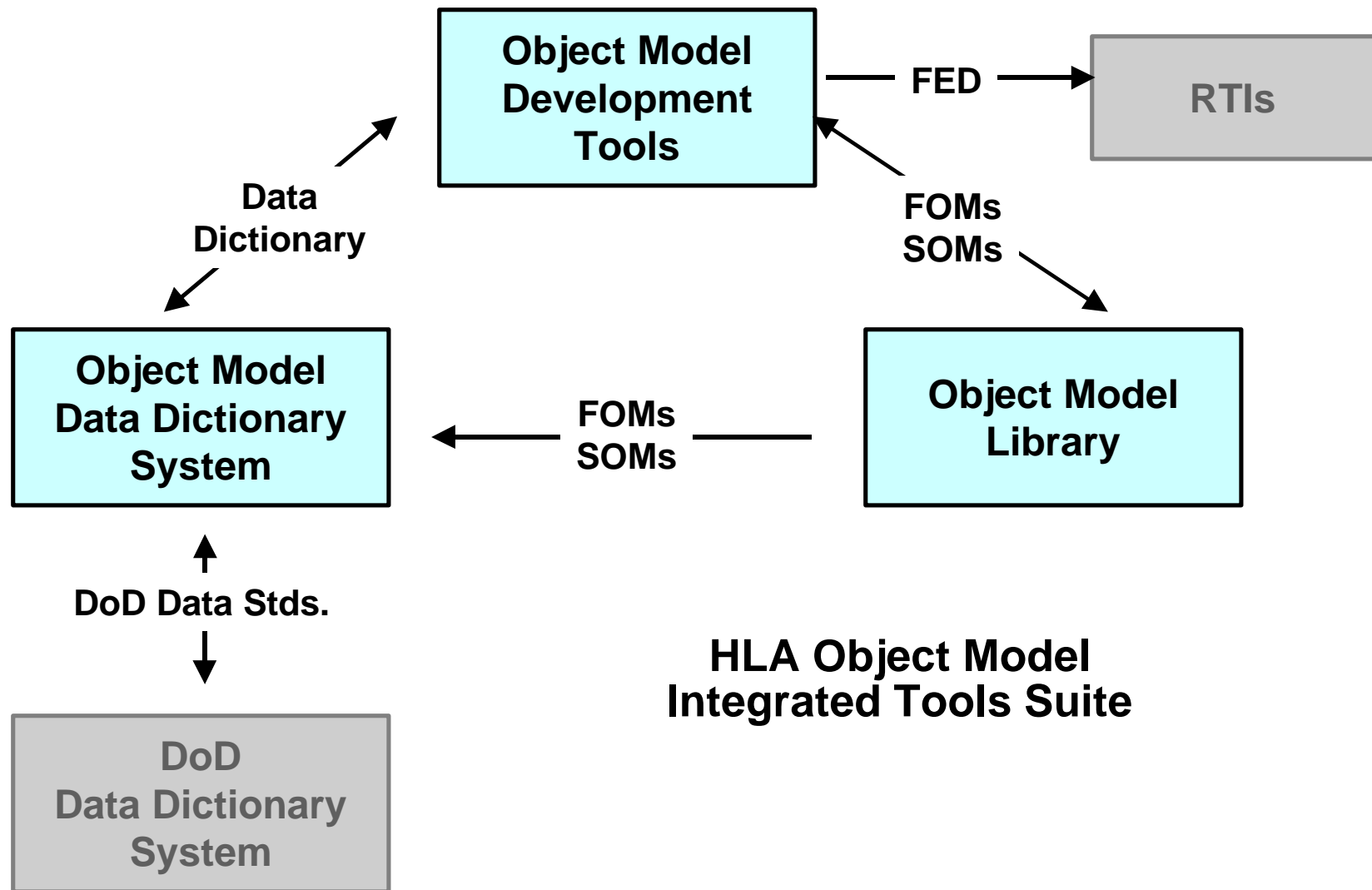
HLA Supporting Software:
Runtime Infrastructure (RTI) Software

- RTI software is available now and can be ordered from DMSO homepage (http://hla.dmso.mil) under topic "HLA Software Distribution Center"

- Each user defines own account name and password
  - user account approved following one-time submission of registration data
  - registered users may access and download any products not previously downloaded
  - Currently six ports for RTI are available
    - each port includes RTI software; Installation guide; User documentation; Test federate; Sample applications
  - once registered you will be automatically notified of new releases

- RTI version 1.0 and version 1.3 are out now

- RTI version 2.0 commercial procurement underway; out late 98 (TBD)

HLA Tool Architecture

MSRR

CMMS

Object Model Library

Data Dictionary System

Authoritative Models

FOMs, SOMs

FOMs, SOMs

Standardized Semantics

Concept Analysis/ Federation Design Tool

Federation Composition

Execution Planning Tool

FOM

Object Model Development Tool

Federation Execution Details

Federation Composition

Mission Space, Requirements

Scenario

Federate-specific Scenario Responsibilities

Federate-specific Scenario Responsibilities

Performance Modeling Tool

Scenario

FOM

Federation Composition

Scenario Development Tool

Scenario

Scenario

Federation Testing Tool

Execution Environment

Runtime Mgmt. Federation Component

Runtime Monitor Federation Component

Data Collection Federation Component

Raw measurements

Post Processing Tool

Reduced MOP/ MOE metrics

VV&A Support Tool

Objectives Development

Conceptual Design

Federation Design/Development

Federation Implementation

Federation Execution

Results and Feedback

- Tool

- Information archive component

→ - Exchange of information

HLA Tool Architecture

Object Model Development Tools --- FED ---> **RTIs**

Data Dictionary

Object Model Data Dictionary System

FOMs SOMs

Object Model Library

FOMs SOMs

DoD Data Stds.

DoD Data Dictionary System

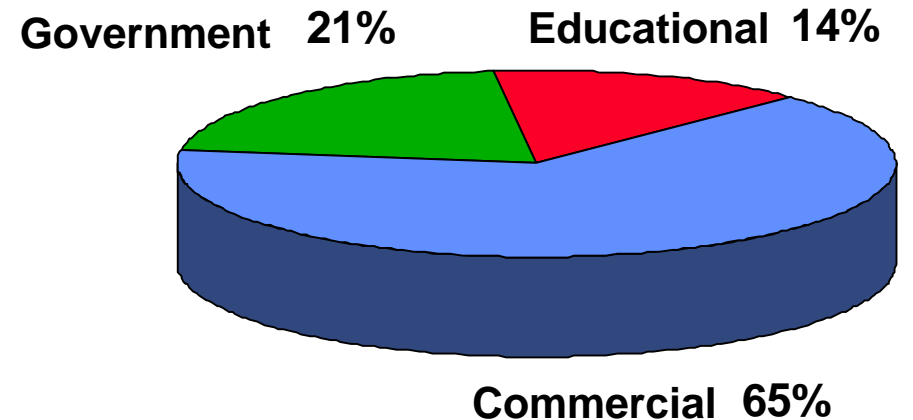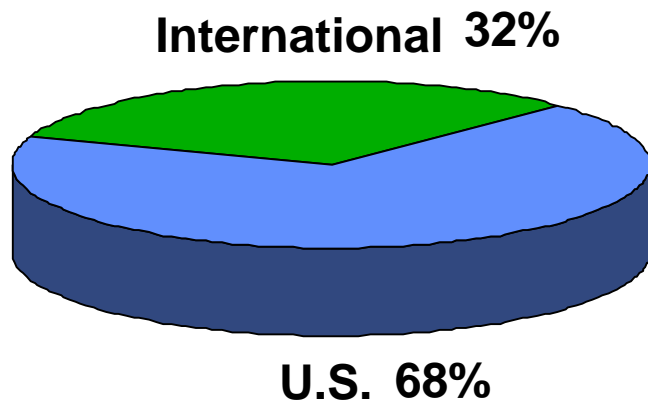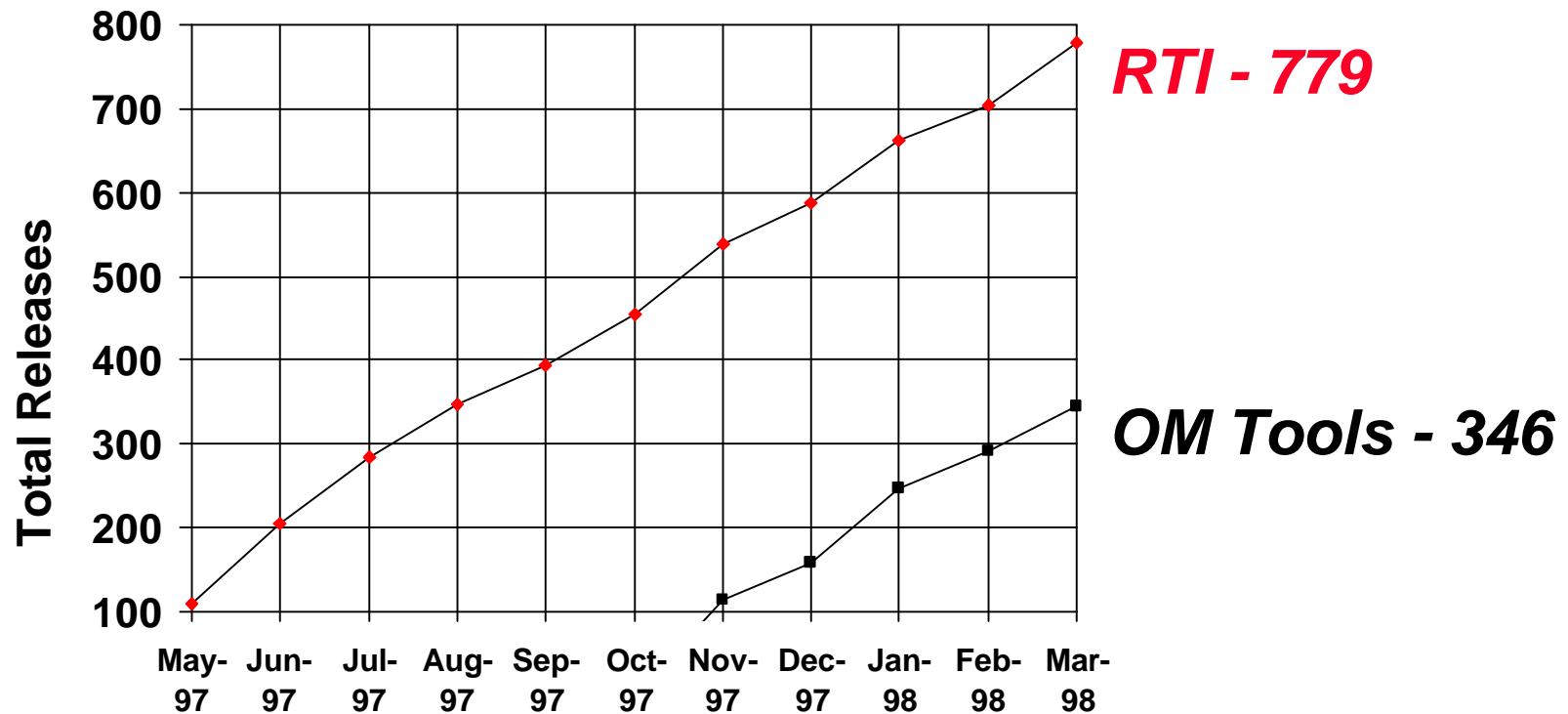**HLA Object Model Integrated Tools Suite**

HLA Supporting Software:
Object Model Support Tools

- **Object Model Development Tools (OMDTs)**

  - **Automated support for development HLA Object Models (OMs), generation of RTI federation execution data, and exchanging OMs with the Object Model Library**

  - **Object Model Library (OML)**

  - **Web-accessible library for storing and retrieving completed HLA object models (SOMs and FOMs)**

- **Object Model Data Dictionary (OMDD)**

  - **An automated catalog of data elements for use in HLA object models**

- **Initial public release of OM tools began October 1997**

  - **Currently one OMDT and access to OML available, same as RTI**

- **Versions compliant with HLA Specification 1.3 released in march 1998**

HLA Software Releases
through March 1998

RTI - 779

OM Tools - 346

Total Releases

800
700
600
500
400
300
200
100

May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98

International 32%

U.S. 68%

Government 21% **Educational 14%**

Commercial 65%

Top International HLA Software Requestors (through March 1998)

RTI

UK	50
GERMANY	36
CANADA	29
FRANCE	25
NETHERLANDS	20
SWEDEN	14
JAPAN	12
AUSTRALIA	15
SOUTH KOREA	10
SINGAPORE	8
SPAIN, TAIWAN (tie)	6

OM Tools

UK	17
GERMANY	12
S. KOREA, AUSTRALIA (tie)	8
NETHERLANDS, CANADA (tie)	7
JAPAN	5
TURKEY	4
SWEDEN	3
NORWAY, RUSSIA, SPAIN TAIWAN, SINGAPORE (tie)	2

New Tool Development

- **Development of additional tools has been initiated**
  - **Continuation of same basic strategy**
    - **DMSO develops initial releases, supported by open data standards to promote commercial developments**
    - **Development and testing will be done with alpha testing groups**
    - **Based on these results tools assessed to be generally useful and supportable will be generally released**
    - **Presentation on tools included in AMG agendas as tool work progresses**

- **New focus on tools to support later phases of the federation life cycle**
  - **Current tools focus largely on OM development**
  - **New tools focus on federation execution planning & verification**
    - **Federation Execution Planners Workbook (FEPW)Tool**
    - **Federation Verification Tool**
  - **and federation execution runtime**
    - **Federation Management Tool**
    - **Federation Data Collection Tool**

HLA User Services

- **DMSO is fostering a broad range of User Services to facilitate the HLA transition**
  - **DMSO HLA Home Page**
  - **HLA Help Desk**
  - **HLA Technical Library**
  - **HLA Education/Outreach**
  - **HLA Compliance Testing**

HLA User Services:
DMSO HLA Home Page

- **Provides full service access to the broad HLA user community**
  - **materials, software distribution, training registration**

HLA User Services:
HLA Help Desk

- **An on-line Help Desk was established in May 97**

- **Focal point for inquiries on HLA**

- **hla@msis.dmso.mil e-mail goes to the HLA Help Desk**
  - **directly responds to general inquiries**
  - **refers**
    - **training requests**
    - **policy questions**
    - **RTI-specific technical questions**
  - **logs and tracks**

- **Increasing level of activity**

HLA User Services:
HLA Education/Outreach

- **Integrated DMSO HLA training/outreach program is underway**
  - primary focus has been on domestic US requirement, but some European training is being conducted (TNO, ESA, ITEC)
  - no cost to recipients other than TDY costs

- **CONOPS evolves with user needs**
  - First phase followed a "request-response approach"; shifting to providing regular training events
  - Continuing to add modules and update materials as the HLA program progresses
  - Partner with external organizations for education (MORS, OMG, SCS, SIW,ITEA)

HLA User Services:
HLA Education/Outreach

- ## Sign-up through HLA home page http://hla.dmso.mil

- **Regional -- Comprehensive introduction to HLA offered monthly**

- **Focused Training -- Half day focused sessions as adjuncts to Regionals or standalone offerings**
  - **HLA Compliance Testing**
  - **Adapting Your Simulation to HLA**
  - **Federation Development and Execution**
  - **Using Automated Tools to Develop HLA Object Models**

- **Hands-on Practicum -- twice a month offerings for implementer-level training in use of HLA**

- **CD education materials to supplement HLA live training**

HLA User Services:
HLA Federate Compliance Testing

- **Compliance to HLA defined in 'HLA Compliance Checklist' and test procedures were developed with baseline definition**

- **Federate compliance testing**
  - **Straightforward, over the network**
  - **Minimal effort required by federate**
  - **A semi-automated Test Management System**
    - **Documented test process in easy-to-use guide: procedures, sizes, submission formats, examples, etc.**
    - **Web-based, on-line test preparation (for federates) and test management (for certification authority), integrated with test tools**
    - **Testing capability placed in operation 31 Oct 97**

- **RTI compliance testing**
  - **Testing system in development**
  - **First use planned for CY98**

HLA in Related Standards Efforts

- **HLA is being promulgated as part of broader standards:**
  - **DoD Joint Technical Architecture (JTA)**
    - HLA is incorporated into JTA 2.0, scheduled for March release
  - **North Atlantic Treaty Organization (NATO)**
    - HLA is named as NATO standard architecture in draft NATO M&S Master Plan prepared by NATO Steering Group for M&S
  - **Simulation Interoperability Standards Organization (SISO) - for IEEE standardization**
    - HLA is a draft IEEE standard, 18 month review process underway
  - **Object Management Group (OMG)**
    - DMSO is an OMG member and co-chairs SIG for Distributed Simulation; HLA interface specification and RTI services are being considered as an OMG RFC

Summary

- **Substantial progress has been made in HLA**
  - Technology development, product development and user support are continuing in an iterative program
  - Experimentation with end-user involvement characterizes process throughout
- **Supporting software tools are being developed and distributed**
  - RTI software is available now, with follow-on versions in the pipe
  - HLA Object Model Tools being released this fall; includes Object Model Development Tools, Object Model Library, & Object Model Data Dictionary support
  - Compliance testing capability in place in October

- **A comprehensive information/education package and process is in place**

- **Efforts are underway to move HLA into JTA, NATO, SISO/ IEEE and OMG standards**